

12th; 60, s, 13th; 56, se., 15th; 60, se., 25th; Tatoosh Island, Wash., 54, e., 13th; 55, e., 26th.

LOCAL STORMS.

With the exception of a severe wind storm, which presented the characteristics of a tornado, reported by Mr. J. T. Richardson, of Clarksville, Tenn., as occurring south of that place, near Orgain's Cross Roads, on the evening of the 16th, no well-defined local storms have been reported for December, 1888, and the following reports by Signal Service observers generally refer to disturbances incidental to the passage of some of the more important areas of low pressure traced on chart i:

17th. Virginia.—Spottsville, Surry Co.: a severe wind and rain storm occurred in the evening, causing considerable damage to property.—*Report of voluntary observer.*

17-18th. Pennsylvania.—Harrisburg: the severe wind and rain storm was very destructive to property in the Cumberland Valley; several houses were unroofed; barns blown down, and fences demolished. The damage is estimated at several thousand dollars.

21st-23d. California.—Los Angeles: the heavy rains caused several minor washouts on the railroads eastward, slightly delaying trains.

24th. California.—Red Bluff: heavy rain began 10.15 a.

m. and continued, with short intermissions, until 7.42 p. m.; many of the streets and sidewalks were flooded and impassable during the storm. *Florida.*—Micco: rain began during night and ended 4.45 a. m.; in that time 6.33 inches were measured, most of which fell between 12.30 a. m. and 4 a. m.; many washouts have been reported, and several small boats were sunk by the storm.

25th. Kansas.—Leavenworth: a sleet storm began 6.20 p. m.; turned to heavy snow about midnight, and ended during the night. The sleet and snow caused much damage to telegraph and telephone wires, and also delayed trains on all roads leading to this point.

25-26th. Missouri.—Kansas City: a severe sleet storm prevailed during the night and ended 10.45 a. m. 26th. The electric light, telephone, and telegraph wires in the city became thickly coated with ice, and gradually succumbed to its weight, extinguishing the electric lights, and seriously crippling the telegraph and telephone service. The damage done by the storm in this city is estimated at several thousand dollars.

26th. Iowa.—Dubuque: sleet and snow fell throughout the night, and rain and snow fell alternately during the day until 5.50 p. m. Railroad trains were delayed, and the telegraph lines were covered with sleet, interfering seriously with telegraphic communication.

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various stations; the highest and lowest depths for December, 1888, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, December, 1888 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La....	29.9	31	12.8	14	3.7	9.1
<i>Arkansas River:</i>						
Fort Smith, Ark....	22.0	28-29	17.0	7, 8, 12	2.0	15.0
Little Rock, Ark....	23.0	31	17.4	6, 7, 8, 9	3.3	14.1
<i>Missouri River:</i>						
Leavenworth, Kans.	20.0	1	5.2	25	4.0	1.2
Kansas City, Mo....	21.0	1, 2, 4, 5, 6, 7	5.8	25-27	4.7	1.1
<i>Mississippi River:</i>						
Saint Paul, Minn....	14.5	1	2.6	10-11	2.0	0.6
La Crosse, Wis....	24.0	2-3	3.0	12	2.6	0.4
Dubuque, Iowa....	16.0	1	3.0	19-20	1.6	1.4
Davenport, Iowa....	15.0	27	2.5	24	0.5	2.0
Keokuk, Iowa....	14.0	28	2.0	22	0.5	2.5
Saint Louis, Mo....	32.0	31	8.5	25	3.7	4.8
Caïro, Ill....	40.0	1	20.0	16-18	9.5	10.5
Memphis, Tenn....	34.0	1	17.9	16, 18, 19, 20, 21	8.0	9.9
Vicksburg, Miss....	41.0	1	27.2	20, 21	9.7	17.5
New Orleans, La....	13.0	4	9.7	29	5.8	3.9
<i>Ohio River:</i>						
Pittsburgh, Pa....	22.0	19	12.2	16	3.2	9.0
Parkersburg, W. Va.	38.0	21	14.7	9	6.2	8.5
Cincinnati, Ohio....	50.0	24	23.8	12	12.5	11.3
Louisville, Ky....	25.0	25	9.6	7, 8	5.8	3.8
<i>Cumberland River:</i>						
Nashville, Tenn....	40.0	24	8.4	16, 17	3.2	5.2
<i>Tennessee River:</i>						
Knoxville, Tenn....	29.0	20	5.6	16	1.3	4.3
Chattanooga, Tenn.	33.0	23	6.9	9	4.0	2.9
<i>Monongahela River:</i>						
Pittsburgh, Pa....	29.0	19	12.2	16	3.2	9.0
<i>Savannah River:</i>						
Augusta, Ga....	32.0	18	19.3	9	8.9	10.4
<i>Willamette River:</i>						
Portland, Oregon....	15.0	19	5.7	1, 2	1.8	3.9

* 12 days record; river frozen remainder of the month.

ICE IN RIVERS AND HARBORS.

The following reports of Signal Service observers refer to the closing of navigation by ice on the Great Lakes and the more northerly rivers:

Lake Ontario.—Oswego, N. Y.: the schooner "Pictor," which left port on the 10th, was the last departure, and navigation is considered closed for the season. The canals were closed to navigation on the 3d.

Lake Erie.—Buffalo, N. Y.: navigation closed on the 15th, the steamer "Romania" being the last arrival of the season. Sandusky, Ohio: navigation practically closed on the 3th. Cleveland, Ohio, 8th: navigation has practically closed for the season. Toledo, Ohio: navigation at this port closed on the 3d, the steam barge "Bessie" being the last departure.

Lake Saint Clair.—Detroit, Mich.: the United States Lightship at Grassie Pointe Flats, Lake Saint Clair, was removed on the 7th, virtually closing navigation at this point.

Lake Michigan.—Manistee, Mich.: navigation was practically closed on the 1st, and entirely closed on the 15th. Green Bay, Wis.: the steamer "Welcome" arrived early on the morning of the 12th from down the bay. She was the last arrival of the season, and navigation is considered closed.

Lake Huron.—Alpena, Mich.: Thunder Bay was frozen over on the 20th; navigation closed.

Lake Superior.—Duluth, Minn.: navigation closed on the 2d, the propeller "Spokane" being the last departure.

Androscoggin River.—Lewiston, Me.: the river froze over on the 15th.—*Report of New England Meteorological Society.*

Baker's River.—Plymouth, N. H.: the river froze over on the 16th.—*Report of New England Meteorological Society.*

Merrimac River.—Newburyport, Mass.: the river froze on the 15th, and opened on the 31st.—*Report of New England Meteorological Society.*

Hudson River.—Poughkeepsie, N. Y., 14th: navigation on the river is about closed. Steamers of the Albany and Troy lines passed here on their last trip this evening going south. The ice at Castleton is fast, and all the bays and coves along the Hudson are frozen over.—*Baltimore Sun, December 15.*

Allegheny River.—Pittsburgh, Pa.: floating ice in river 14th to 18th, 21st to 25th, 27th to 31st.

Monongahela River.—Pittsburgh, Pa.: floating ice in river 20th, 23d to 25th, 27th, 28th.

Saint Clair River.—Port Huron, Mich.: navigation closed on the 11th; the steam barges "Romania" and "Australia" were the last boats to pass this point. Fort Gratiot light was discontinued on the 19th. Floating ice in river on the 22d; it was free from ice on the 25th.

Mississippi River.—Keokuk, Iowa: the Warsaw packet "Patience" went into winter quarters on the 18th, ending navigation for the season; floating ice in river 19th and 28th.

Dubuque, Iowa: floating ice in river 12th, 13th, 18th; the river froze over on the 27th. La Crosse, Wis.: floating ice in river 11th to 14th, 17th to 20th; the river froze over on the 21st; it opened again on the 23d, and navigation, which had been interrupted since the 21st, was resumed; floating ice in river on the 26th; it froze over again on the 27th, when navigation closed for the season. Saint Paul, Minn.: the river was gorged by ice during the night of the 14-15th a short distance below the landing at the foot of Jackson street; the ice dam increased gradually up to the 22d, at which time it had reached the Jackson street landing.

Missouri River.—Omaha, Nebr.: floating ice in river 2d, 3d, 4th, 18th. Bismarck, Dak.: navigation closed on the 2d.

Saint Mary's River.—Sault de Sainte Marie, Mich.: the locks in the canal were closed on the 3d, and navigation suspended at this place and Lake Superior point.

Little Arkansas River.—Wichita, Kans.: the river froze over on the 20th.

FLOODS.

Harrisburg, Pa.: owing to the heavy rains which fell during the storm of the 17-18th the Susquehanna River rose very high, flooding lowlands.—*Report of Signal Service observer.*

HIGH TIDES.

Key West, Fla., 4th; Southport, N. C., 23d. Provincetown, Mass., 8th: the tide was unusually high during the past week.—*Report of New England Meteorological Society.* Eastport, Me.: high tides occurred from the 3d to the 7th; the highest tide previously noted occurred in 1869; on the 5th of the present month it rose five inches higher than in 1869, overflowing several of the wharves; the wind was light at the time and little damage was caused.—*Report of Signal Service observer.* Asbury Park, N. J.: the severe wind storm on the morning of the 11th caused the tide to rise very high, entirely destroying a number of the cottage bulk-heads at Monmouth Beach, which were partially torn out by a storm two weeks ago.—*The New York Sun, December 12.*

ATMOSPHERIC ELECTRICITY.

AURORAS.

Faint auroral displays were reported as far south as Clayton and Egg Harbor City, N. J. To the westward of the Atlantic coast states no auroras were observed south of the forty-fourth parallel, and none were noted at stations in the Lake region. They were most frequently reported at Saint Vincent, Minn., and were seen on from one to three dates at stations in Dakota and northeastern Montana.

The most notable display of the month occurred at Saint Vincent, Minn. "It was first observed at 11 p. m., 23d, as an irregular, diffused light; at 11.30 p. m. a distinct arch had formed which rose to about altitude 40° and covered about 160° azimuth."—*Report of Signal Service observer.*

Auroras were observed during the month as follows: 1st, Clayton, N. J. 3d, Spring Lake, Dak.; Saint Vincent, Minn. 4th, Fort Sully and Spring Lake, Dak. 5th, Fort Buford and Fort Sully, Dak. 7th, Saint Vincent, Minn. 8th, Fort Buford, Dak.; Poplar River, Mont. 23d, Fort Totten, Dak.; Saint Vincent, Minn.; Wedgewood, N. Y.; Eagle's Mere, Pa. 24th, Fort Totten, Dak.; Saint Vincent, Minn. 25th, Davenport, Dak.; Saint Vincent, Minn. 26th, Egg Harbor City, N. J.

29th, Orono, Me.; Saint Vincent, Minn. 30th, Fort Assinaboine, Mont.

THUNDER-STORMS.

Thunder-storms were reported during the month, by states and territories, as follows: 2d, 1; 3d, 1; 8th, 9th, 12th, and 13th, 1; 14th, 2; 15th and 16th, 4; 17th, 1; 22d, 2; 23d, 4; 24th, 2; 25th and 26th, 3; 27th, 2; 29th, 1; 30th and 31st, 2. None were reported on the 1st, 4th to 7th, 10th, 11th, 18th to 21st, and 28th.

Thunder-storms were reported in the several states and territories, by days, as follows: Ariz., 5; Ark., 1; Cal., 1; Fla., 2; Ga., 1; Ind. T., 2; Kans., 1; La., 6; Md., 1; Miss., 1; Mo., 5; Nebr., 1; N. J., N. M., N. Y., 1; Tex. 8. In Ala., Colo., Conn., Dak., Del., D. C., Idaho, Ill., Ind., Iowa, Ky., Me., Mass., Mich., Minn., Mont., Nev., N. H., N. C., Ohio, Oregon, Pa., R. I., S. C., Tenn., Utah, Vt., Va., Wash. Ter., W. Va., Wis., and Wyo. no thunder-storms were reported.

Thunder-storms were reported in the greatest number of states and territories (4) on the 15th, 16th, and 23d.

They were reported on the greatest number of days (8) in Texas. In Louisiana they were noted on six, and in Arizona and Missouri on five days.

MISCELLANEOUS PHENOMENA.

PRAIRIE FIRES.

Bismarck, Dak., 9th: large prairie fires are raging seven miles northwest of station; nearly 1,000 acres of pasture have been burned over, and about sixty tons of hay and one ranch building consumed. Prairie fires also occurred to the east of station on the 22d.

Prairie fires also occurred on the following dates: Fort Buford, Dak., 1st; Parkston, Dak., 23d; Fort Sill, Ind. Ter., 1st, 2d, 3d, 10th to 13th.

HALOS.

Solar halos were most frequently noted in California and Illinois, where they occurred on twelve days. In Indiana they were reported on ten days; in Ariz., Fla., Iowa, Md., Mass., N. J., N. Y., Ohio, Oreg., Tenn., Tex., Vt., and Wis. on from five to nine days. None were reported in Ala., Colo., Del., D. C., Idaho, Me., Miss., Mo., Nev., N. Mex., R. I., Utah, W. Va., and Wyo. They were reported in the greatest number of states and territories, twenty, on the 7th; in twelve on the 11th, and in eleven on the 8th. On the 3d, 5th, 10th, 13th to 16th, 25th, 26th, and 31st they were noted in from five to ten

states and territories. The 2d was the only day on which solar halos were not observed in some portions of the country.

Lunar halos were most frequently reported in California and Tennessee, where they were observed on twelve dates. In Indiana they were noted on ten dates, while in Ala., Ariz., Dak., Iowa, Kans., Ky., La., Md., Mich., Minn., Mo., Mont., Nebr., Nev., N. J., N. Y., Oregon, Pa., S. C., Tex., and Va. they were reported on from five to nine dates. None were reported in Ark., Del., and R. I. They were reported in the greatest number of states and territories, twenty-seven, on the 11th; in twenty-three on the 12th, and in twenty-one on the 15th. On the 7th, 9th, 10th, 13th, 16th, 18th, 19th, and 26th they were reported in from ten to twenty states and territories. On the 1st, 2d, 28th, and 31st no lunar halos were observed.

REMARKABLE LUNAR HALO.

The following description of a remarkable lunar halo has been received from Prof. E. A. Hallett, of Borden Institute, New Providence, Ind.: "December 11th, 10 p. m.—At 8.43 p. m. (ninetieth meridian time), I noticed a bright circle passing through the moon in its southern side, and extending about